

Ranch Advisory Partners Case Study Series: Early Warning Indicators

This three part series of case studies is designed to provide illustrative examples regarding early warning indicators. These case studies, taken from actual Wyoming and Montana ranches, include examples of using early warning indicators to signal when corrective action is necessary, when no corrective action is necessary, and creating a plan to evaluate success of grazing management changes.

Early Warning Indicators on Rangeland: Case Study 1 of 3

In the course of our work, we are often asked about early-warning indicators that signal rangelands are responding in a particular direction to a specific management practice. That is, if a new grazing strategy is implemented, producers often want to know what the earliest signals that observed on the land that suggest biological processes are responding either favorably or unfavorably to that strategy. This three part series examines three different case studies that provide examples of identifying and acting on information from early warning indicators.

"Early" warning indicators refer to early in time, as opposed to "late" warning indicators, which occur later in the change process. If management actions are improperly applied, those early-warning indicators provide the first glimpses that something is awry, and the grazing strategy can be altered before costly (and "late") fixes are needed.

The best way to learn about early-warning indicators is to use examples and case studies. On a recently-visited Wyoming ranch, managers were considering implementing a new grazing strategy to improve pasture performance, increase stocking rate, and increase revenue. They wanted to balance such important grazing variables as pasture grazing duration, stock density, recovery time between grazing events, and timing of grazings. They needed advice on determining whether or not to change grazing strategies and how best to do it.

Based on examination of the pastures and rangeland monitoring data, we learned that corrective actions were warranted to improve overall rangeland health and performance of the pastures. The early-warning indicators that needed changes were:

- 1) **Plant vigor** was not optimal relative to recent climatic conditions. The area had received summertime rains, yet the perennial grasses were not thriving like they should have been. Many of the grasses had not reached tall stature, or produced seed as was expected. This indicator suggested a problem may have existed with spring grazing duration.
- 2) **Too much bare ground** was found in the pastures. Given the ranch's location, soils, and precipitation, nearly no bare ground should have been found here, but much of the soil was simply not producing anything.
- 3) **Decay of old plant material** (known as "litter") was slower than expected. Cow manure was over three years old, and was not breaking down as rapidly as it should have been. Ideally, cow manure should have been less than two years old on these pastures.
- 4) **No recruitment** of desired perennial bunchgrasses was occurring. Pastures had the opportunity to grow many more bunchgrasses that are both highly producing and high in nutrient content, yet those plants were not there. This provided more evidence that a change in grazing strategy was required.

After examining these findings, we worked with the ranch to alter stock density in the pastures and grazing duration. This ranch previously grazed one of the pastures for 45 days during the critical Wyoming spring growing window. In this setting, 45 days was much too long. Fortunately, the ranch had an additional pasture available, and could split the pasture of concern into two units with a very short length of fence, thus providing three new pastures to be utilized.

Based on the early warning indicators shown, the spring grazing duration was then reduced from 45 days in one pasture to 15 days spread over the same area divided into three pastures. The recovery period between grazing events was also lengthened, which gave the desired bunchgrasses much more growth time. Lastly, the stock density was nearly tripled, which will help with the decay process.

In coming years, we will continue to check early-warning indicators in the pastures to ensure progress is being made. The ultimate sign of improvement for this ranch will be that desired increase in stocking rate, which should help improve revenue with no change in cost structure.

Early Warning Indicators on Rangeland: Case Study 2 of 3



In part one of this three part case study series, we examined the use of early-warning indicators that suggest changes in grazing strategy is required. Here is another case study based on another Wyoming ranch that offers a different perspective.

On a different Wyoming ranch than in the first example, managers changed the grazing strategy in a series of pastures roughly five years ago, and they wanted to determine if the new program was producing desired results. A quick walk through their pastures showed the following:

1) Plant vigor was high relative to recent climatic conditions. No summer rains had fallen recently, yet desired perennial bunchgrasses appeared to be tall, growing, and had produced seed. This was encouraging.

2) Pastures displayed few patches of bare ground, showing the soil was producing as it should in that climate.

3) Rates of decay in both plant material and cow manure appeared to be high. This suggested strong nutrient cycling.

4) Recruitment of highly desired perennial bunchgrasses was easily evident. In this example, young members of needleandthread and green needlegrass were readily apparent on the soil surface, suggesting their presence was increasing.

The ranch crew could see these four early-warning indicators when riding the pasture and checking herd health. Their management strategy was successfully leading the resource in the desired direction with tangible results. They believed the balance of important grazing variables such as grazing duration, plant recovery period between grazings, timing of grazings, and stock density was where they wanted them to be. The correctly determined that no changes to their overall grazing strategy were warranted.

Early Warning Indicators on Rangeland: Case Study 3 of 3



In parts one and two of this series, we examined early warning indicator scenarios on Wyoming ranches. The four indicators discussed in each case study demonstrated clear examples of when action should be taken to correct worrisome issues. Part three, using the example of a Montana ranch, analyzes a more complex scenario.

Relative to the prior two Wyoming examples, the recently-visited Montana ranch lies in a higher precipitation zone, higher elevation, and higher level of productivity. Often times in low-producing areas, as seen with the Wyoming examples, mistakes in grazing management lead to increased bare ground. As seen in Montana ranch example, grazing management errors in high-producing areas often lead to undesired shifts in plant species composition. Due to geographical and ecological differences, early warning indicators are more nuanced in higher-producing areas.

In this Montana ranch example, the ranch crew was considering constructing a new cross fence to subdivide a pasture into two units to improve grazing distribution and shorten the grazing duration. They wanted to know how this action would alter future performance of the pasture and how they would be able to tell if their strategy was being applied successfully.

After walking through the pasture, we determined that the early-warning indicators that would show that problems were occurring with implementation of the new strategy would be these:

- 1) Plant vigor would fall.** If the grazing strategy was poorly implemented, plants would not be able to achieve tall stature, they would not produce seed, and they would not be firmly rooted to the soil surface. This would be the earliest indicator suggesting that corrections in grazing management are required.
- 2) Undesired shifts in plant species composition would occur.** In this pasture, the undesired grass timothy would increase its presence. This species is undesired on this ranch because it tends to be much less palatable than other perennial bunchgrasses. Thus, managers wanted other grasses to grow rather than timothy. If timothy's presence were to increase in the future, then changes in the grazing program were warranted.

Conversely, if management actions are properly applied in the future, managers should look for these indicators that would signal preliminary success:

1) Plant vigor would be strong, even in dry years. These suggest the water cycle is effective and desired grasses have enough energy to achieve tall stature and produce seed. This should be the case even in less rainy years.

2) Shifts in plant species composition should occur that favor the growth of more desired perennial bunchgrasses. A quick walk through the pasture would show that the highly favored grasses were doing well relative to the less-desired timothy.

This example shows how a ranch crew can quickly assess tangible factors that serve as early indicators of success or failure. Monitoring early warning indicators allows for early correction of management plans that can save ranches significant expense and effort.

As shown in each of the three case studies, ranchers should monitor their property for early warning indicators that suggest change in grazing management is needed. While indicators vary based on precipitation zone, elevation, soil, and other factors, early warning indicators provide benchmarks to evaluate ranch management.